

# 2017 SOUTH FLORIDA Environmental Report



Kissimmee River floodplain

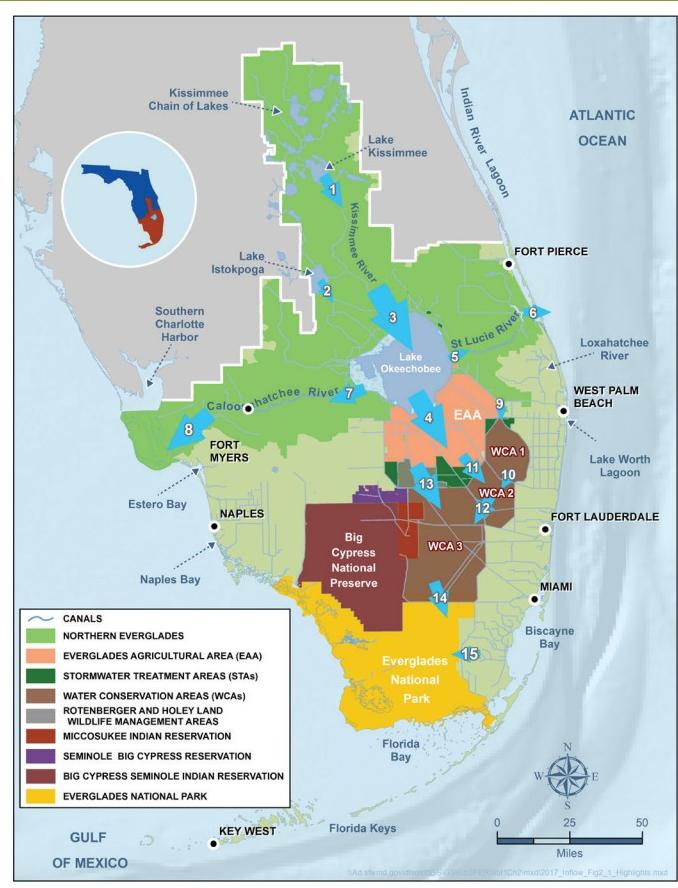
## HIGHLIGHTS

Historic amounts of rainfall from El Niño marked Water Year 2016 requiring the Department of Environmental Protection (FDEP) and the South Florida Water Management District (SFWMD) to manage the water and respond to unprecedented levels throughout South Florida. The agencies also continued to make significant progress on the main goal of building major projects that will help restore South Florida's ecosystem – from the Kissimmee River to Florida Bay and all points in between. In April 2016, Governor Rick Scott signed the Legacy Florida legislation, which provides at least \$200 million annually in dedicated funding for Everglades restoration.

The 2017 South Florida Environmental Report documents a year of restoration, scientific and engineering accomplishments in the Kissimmee Basin, Lake Okeechobee, Everglades and South Florida coastal areas. The report also provides extensive peer reviewed research summaries, data analyses, financial updates and a searchable database of environmental projects.

The full report covers environmental information for Water Year 2016 (May 1, 2015 – April 30, 2016) and project/budgetary information for the SFWMD Fiscal Year 2015-2016 (October 1, 2015 – September 30, 2016). The full 2,380-page report is available online at [www.sfwmd.gov/sfer](http://www.sfwmd.gov/sfer).

## Inflows/Outflows Water Year 2016



Map ID	Water Body	WY2016 Flows (acre-feet)	WY2015 Flows (acre-feet)
1	Lake Kissimmee Outflows	941,604	1,170,556
2	Lake Istokpoga Outflows	498,502	446,215
3	Lake Okeechobee Inflows	2,984,077	2,831,832
4, 5, 7	Lake Okeechobee Total Outflows	2,323,309	1,933,353
4	Flows to the south from Lake Okeechobee	962,102	1,228,155
5	Flows into the St. Lucie Canal from Lake Okeechobee	388,303	129,227
6	Flows into the St. Lucie Estuary through the St. Lucie Canal	558,412	188,236
7	Flows into the Caloosahatchee Canal from Lake Okeechobee	972,904	575,971
8	Flows into the Caloosahatchee Estuary through the Caloosahatchee Canal	1,929,150	1,234,173
9	Water Conservation Area 1 Inflows	351,943	245,360
10	Water Conservation Area 1 Outflows	350,425	198,051
11	Water Conservation Area 2 Inflows	864,470	823,996
12	Water Conservation Area 2 Outflows	872,912	810,056
13	Water Conservation Area 3 Inflows	1,575,428	1,312,417
14	Water Conservation Area 3 Outflows	1,368,423	779,167
14, 15	Everglades National Park Inflows	1,566,604	1,015,301

Inflow/outflow map depicts flow numbers for acre feet\* of water for Water Year 2016 (May 1, 2015– April 30, 2016) moved through the water management system. In December 2015 and January 2016, the historic amount of rainfall received throughout the region required flexing the Central and South Florida Flood Control system. Constructing temporary features to move more water helped mitigate the effects of higher water levels.

Emergency operations (implemented by SFWMD and U.S. Army Corps of Engineers) minimized harmful impacts -- flooding and degradation of water quality -- to the environment, the public, adjacent properties and downstream receiving waters.

\*An acre-foot of water is the volume needed to cover 1 acre of land with 1 foot of water.

## Everglades Water Quality

### Everglades water quality continues to show improvement.

Unimpacted portions of the Everglades Water Conservation Areas passed all four parts of the state's total phosphorus (TP) rule as – indicated in the most recent five-year TP criterion assessment. With a few exceptions, similar to previous years, water quality was in compliance with existing state water quality criteria during Water Year 2016.

During the emergency operations period in response to extreme rainfall, TP concentrations measured at or below average for this time of the year. Across the Everglades Protection Area, 76 percent of the interior marsh water quality monitoring sites, representing 90 percent of the geographic area, were at or below 10 parts per billion (ppb). Everglades National Park concentrations averaged 4 ppb for the water year.

This reflects the continued recovery from recent climatic extremes, improved treatment of the inflows and overall improvement in phosphorus conditions within the interior marsh due to ongoing restoration activities.

## Everglades Stormwater Treatment Areas

Over a 22-year operational history, the Everglades Stormwater Treatment Areas (STAs) have treated more than 17.5 million acre-feet of water and have retained approximately 2,220 metric tons of total phosphorus (TP). In Water Year 2016, with 57,000 acres of treatment area, the STAs treated 1.4 million acre-feet of water – more than 1 million acre-feet from agricultural and urban runoff and 243,000 acre-feet from Lake Okeechobee.

STAs reduced both inflow TP load and concentration by 86 percent, keeping 208 metric tons of TP from entering the Everglades Protection Area. Collectively, the STAs reduced TP concentrations heading south to 20 parts per billion.

## Nutrient Source Control Programs

### Farming best management practices (BMPs) on agricultural lands in South Florida is a unique program in South Florida.

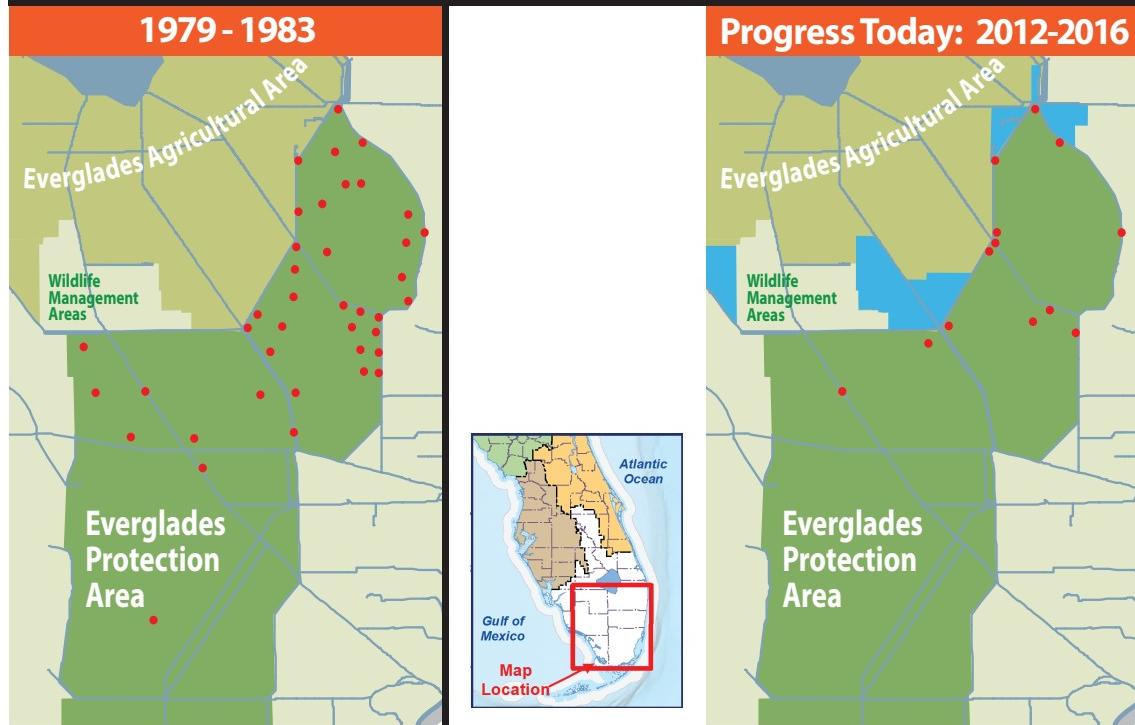
The SFWMD Everglades Program mandates quantifiable phosphorus reductions at the source. Long-standing success is attributable to BMP plans using practical cost-effective measures for phosphorus inputs, stormwater management and soil conservation fused with multilevel monitoring and tracking.

In Water Year 2016, the Everglades Agricultural Area (EAA) reduced TP load in stormwater discharges and surpassed mandated levels for the 21st year. By curbing nutrients at the source, BMPs have removed 3,055 metric tons of phosphorus since 1996. Average reduced TP in agricultural runoff from 47,000 acres south of Lake Okeechobee is 55 percent since the program's inception.

## Restoration Strategies:

### Clean Water for the Everglades

Major milestones have been reached in design, construction and operation of Restoration Strategies projects. With one of three flow equalization basins (FEBs) complete and construction nearing completion on another, approximately 105,000 acre-feet of additional water storage will be provided and phosphorus



**FROM 24 PARTS PER BILLION TO 9 PARTS PER BILLION:** The reduction in average phosphorus concentrations in water within the Everglades over the past two decades.

treatment performance of downstream Everglades STAs will be enhanced.

Construction of 4,300 acres of additional effective treatment at STA-1 West is underway. Overall, Restoration Strategies is being implemented as planned. The following milestones were reached in Water Year 2016:

- Construction of A-1 FEB (60,000 acre-feet of storage capacity) completed and operational testing and monitoring initiated
- L-8 FEB (45,000 acre-feet of storage capacity) construction ongoing and nearing completion
- STA-1 West Expansion #1 (4,300 acres of additional effective treatment area) design completed in June 2015 and construction underway November 2015

#### Ongoing conveyance improvements:

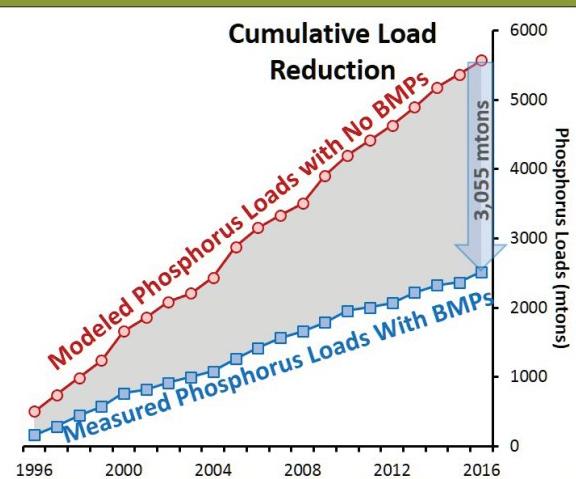
- Construction of the Bolles East L-16 Canal Conveyance Improvements began August 2015, more than 7 years ahead of schedule; expected to continue through at least Water Year 2017
- Modifications to Structure S-5AS completed May 2016
- Construction of the S-375 Expansion (G-716) began November 2015; anticipated to be complete by April 2017
- L-8 Divide Structure (G-541) construction completed more than 2 years ahead of schedule in July 2016

**Work continues on nine scientific studies being implemented as part of the Restoration Strategies Science Plan.** The primary objective of these studies is to investigate ways for improving operation and management of the STAs to optimize treatment performance and help achieve the water quality based effluent limit for TP. Preliminary results are available for the evaluation of soil amendments, periphyton-based STAs, influence of canal conveyance features, cattail sustainability and phosphorus cycling and release within the STAs.

Progress has been made on improving water and phosphorus budgets and developing operational guidelines for FEB and STA operation. Initial investigation on TP sampling methods has been completed. Planning for the next five-year work plan for Science Plan projects is underway.

#### Everglades Ecology and Invasive Species

**Results of monitoring, modeling and assessment of Everglades hydrology, ecosystem function and landscape change have yielded useful results for restoration efforts.** Programs of study focus on short-term operational needs and long-term restoration goals. They encompass large-scale and regional hydrologic needs in relation to regulation schedules, permitting, Everglades Forever Act mandates and the Comprehensive Everglades Restoration Plan



Best management practices have prevented 3,055 metric tons of phosphorus from entering the Everglades since 1996.



*As part of Restoration Strategies, the A-1 Flow Equalization Basin will create 60,000 acre-feet of storage capacity. Construction is complete and operational testing and monitoring have begun.*

(CERP). Some key findings are described below.

- Studies at the **Loxahatchee Impoundment Landscape Assessment (LILA)**, a large-scale physical model replicating the Everglades Landscape located at the Arthur R. Marshall Loxahatchee National Wildlife Refuge, determined that restoration of ghost tree islands may be possible by planting native tree saplings in peat bags.
- A third **Decomp Physical Model** flow event provided information on the effects of flow needed to restore sediment transport and landscape patterning to the Everglades.
- An estimated 18,000 **wading bird nests** were started in the Water Conservation Areas and Everglades National Park during the 2016 nesting season (December to July). This was the wettest dry season in 58 years and high water levels created low food availability for wading birds. All indicator species (white ibis, wood stork, great egret, snowy egret, and tricolored heron) exhibited reduced nesting effort in 2016 (between 23 and 74 percent below the 10-year average).

- The **S-356 Incremental Pump Test**, part of the Modified Water Deliveries to Everglades National Park, modified deliveries of water to Shark River Slough and evaluated flow direction and water quality. Surface water movement from culverts east of the One-Mile Bridge moved to the east, believed to be in step with groundwater seepage. West of the One-Mile Bridge, flows were observed to be directed towards Shark River Slough.

#### **Efforts on exotic invasives control continue.**

Many efforts are underway to control exotic species. SFWMD has one of the nation's largest aquatic plant management programs, controlling floating and submerged aquatic vegetation systemwide. Biological control of several invasive plants is showing promising results, with substantial reductions of melaleuca documented.

CERP's Biological Control Implementation Project now supports biological control agent rearing and field release for melaleuca, Old World climbing fern, water hyacinth, air potato and other invasive nonindigenous plant species. SFWMD continues to coordinate invasive species management efforts with other agencies and

Invasive nonindigenous species often present serious threats to native ecosystems throughout South Florida. Multiple agencies are actively engaged in coordinated efforts to control highly invasive species such as Old World climbing fern, melaleuca, Burmese pythons and Nile monitors. Successfully managing invasive species is important to other strategic goals – from evaluating environmental resource permits to managing the Everglades STAs to restore natural fire regimes.

### **What is phosphorus?**

Although it is a vital nutrient in all natural systems, phosphorus is also a fertilizer component. It flows across the landscape in stormwater runoff (urban and agriculture), harming natural areas by promoting algae growth and an overabundance of non-native plants, crowding out natural vegetation and disrupting food sources and habitats used by native wildlife. The Everglades is naturally a low-nutrient system. Even small amounts of additional nutrients can upset the ecological balance needed by the native plants and animals in the historic "River of Grass." Phosphorus is normally recorded in parts per billion (ppb).

### **What is an STA?**

Stormwater treatment areas (STAs) are large, constructed wetlands with inflow and outflow structures for controlling water movement. Aquatic plants in the STAs remove and store excess nutrients (phosphorus) found in the stormwater runoff through growth and the accumulation of dead plant material in the layers of sediment. This natural process cleanses the water before it is moved out of the STA and into the Everglades or other water bodies. The 57,000 acres of STAs operated by SFWMD have removed 2,220 metric tons of phosphorus in 22 years of operation.

### **What is an FEB?**

Flow equalization basins (FEBs) are constructed impoundments designed to capture stormwater runoff and provide a more steady flow of water to the STAs, helping to maintain desired water levels needed to achieve optimal water quality improvement performance. SFWMD is constructing 60,000 acre-feet of FEB and 48,000 acre-feet are near completion.

### **How much is an acre-foot?**

An acre-foot is the volume needed to cover 1 acre of land with 1 foot, or 325,851 gallons, of water.



This photo shows defoliation of Old World climbing fern by the brown lygiod moth, a biological control agent. It presents a serious threat to many habitats in the South Florida ecosystem. Highly invasive and nonindigenous, the fern rapidly displaces native flora and fauna and negatively alters ecosystem functions such as fire regime. Everglades tree islands in A.R.M. Loxahatchee National Wildlife Refuge, swamps in the Kissimmee River floodplain and marshes of southwestern Everglades National Park are experiencing severe impacts due to its spread. In 2015, surveys documented a 600 percent increase of Old World climbing fern in the Everglades Protection Area compared to 20 years ago.

tribes throughout the region with more than 158,000 acres swept for invasive plants in Fiscal Year 2015-2016.

## Lake Okeechobee/Northern Everglades and Estuaries Protection Program

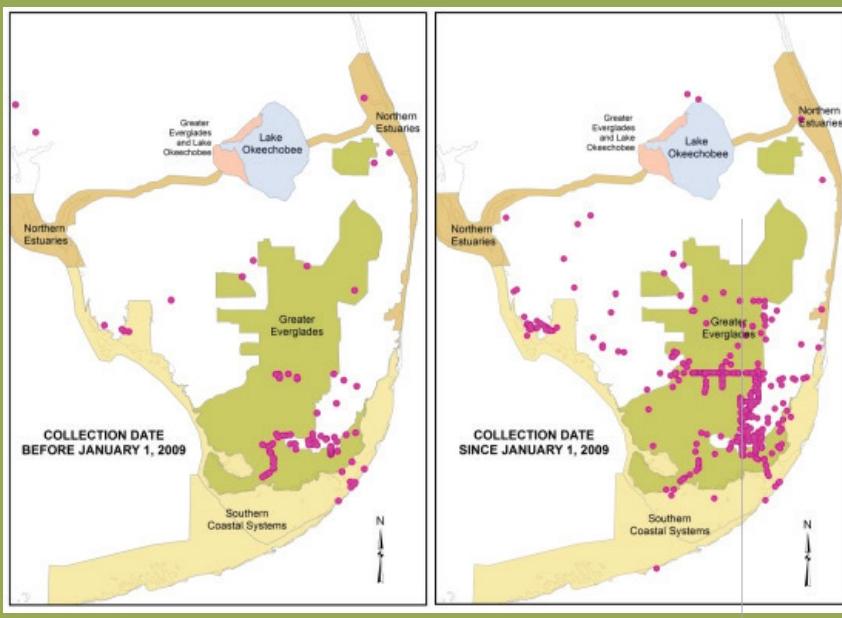
In 2016, the Florida legislature amended the Northern

**Everglades and Estuaries Protection Program (NEEPP)** to strengthen provisions for implementing basin management action plans (BMAPs). NEEPP builds upon ongoing restoration in the Lake Okeechobee, St. Lucie River and Caloosahatchee River watersheds.

**Projects and initiatives targeting improvements in water quality and water storage in the Northern Everglades are progressing.** The following are highlights:

- **FDEP BMAP Updates:** Progress designed to implement nutrient reductions established by the total maximum daily loads (TMDLs) for the Northern Everglades basins continued. Reports available at [www.dep.state.fl.us/water/watersheds/bmap.htm](http://www.dep.state.fl.us/water/watersheds/bmap.htm).
- **Lake Okeechobee Watershed Construction Projects:** The second part of construction for the Lakeside Ranch STA are included in these projects. Construction activities also continued for the Kissimmee River Restoration Project. Operations continue for Lakeside Ranch STA, Taylor Creek STA and Nubbin Slough STA projects.
- **St. Lucie and Caloosahatchee River Watersheds Construction Projects:** Construction began for CERP Caloosahatchee River (C-43) West Basin Storage Reservoir Project and construction continued for CERP Indian River Lagoon South – C-44 Reservoir/STA Project. Construction was completed for Phase I mesocosms of C-43 Water Quality Treatment and Testing Facility, design was completed for the Lake Hicpochee Hydrologic Enhancement – North Project, and a remediation project for water storage was implemented at Ten Mile Creek.
- **Dispersed Water Management Program:** Storage, retention and detention created by 40 completed and operational projects through Water Year 2016 is approximately 91,662 acre-feet per year. FDEP identified six new regional-scale BMAP-related projects – known as Northern Everglades Public-Private Partnerships – to retain rainfall and store excess surface water from the regional system to help address nutrient loads. Funded through state appropriations by the Florida legislature, SFWMD is tasked with developing and executing contracts for each of these projects.
- **Agricultural Non-Point BMP Update:** Florida Department of Agriculture and Consumer Services (FDAC) adopted a revised vegetable and agronomic crop manual in late 2015 and a dairy manual in 2016. As of March 31, FDACS has enrolled 1,793,931 acres in the Lake Okeechobee Watershed, 255,221 acres in the St. Lucie River

Burmese Python Population Increase



Maps depict locations of Burmese pythons removed from South Florida from 1999 through 2008 (left) and from 2009 to present (right). The Burmese python continues to wreak havoc in the greater Everglades ecosystem, especially in Everglades National Park. These large snakes reproduce rapidly and breed large numbers that feed on mammal such as rabbits and small deer, decimating whole populations of species.

Watershed and 430,379 acres in the Caloosahatchee River Watershed into their BMP program. Further details available at [www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy](http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy).

### Lake Okeechobee and Its Watershed

**Implementation of the comprehensive Research and Water Quality Monitoring Program for the lake and its watershed continues.** Research, monitoring, modeling and assessment projects were initiated, ongoing and/or completed. Over 2.3 million acre-feet of water was released from Lake Okeechobee in Water Year 2016, 21 percent greater than in Water Year 2015 (1.91 million acre-feet). Regulatory releases by the U.S. Army Corps of Engineers to the estuaries comprised more than half of this discharge, made throughout the year based on the current Lake Okeechobee regulation schedule. Submerged aquatic vegetation in Lake Okeechobee increased slightly to a total coverage of 33,300 acres.

### St. Lucie and Caloosahatchee River Watersheds

El Niño conditions caused significantly higher than normal rainfall during the dry season resulting in unusual patterns of hydrology, water quality and ecology in St. Lucie and Caloosahatchee River estuaries. In the **St. Lucie Estuary**, with a majority of inflow occurring in the dry season, annual mean oyster larval recruitment was the highest over the past 10 water years and continued to support natural recovery of oyster populations despite extremely low salinities at times.

In the **Caloosahatchee River and Estuary**, due to relatively high



*In support of the Northern Everglades and Estuaries Protection Program, (NEEPP) more than 3,000 acres of cattail were treated in Moonshine Bay in Glades County with herbicides during summer 2015. In November 2015, the dead cattail thatch was burned to prevent plant material from further degrading fish habitat. Numerous Everglades snail kites were observed foraging for apple snails over the burned areas.*

inflow in the dry season, both the daily average salinity goal and 30-day moving average goal at the Ft. Myers monitoring station were fully achieved this water year. Density of live oysters continued to remain high at the Bird Island site and notably rebounded further upstream at the Iona Cove site.

### Kissimmee River Restoration

**Construction for the Kissimmee River Restoration Project nears completion.** The U.S. Army Corps of Engineers awarded the last remaining backfilling contract for Reach 2, the last phase of construction. Backfilling of MacArthur Ditch in the central floodplain is nearing completion.



**Kissimmee River Restoration:** The last phase of construction, Reach 2, and the nearly-complete work immediately downstream will backfill an additional 8.5 miles of flood control canal, restore flow to approximately 16 miles of river channel and seasonally inundate nearly 10,000 acres of floodplain wetlands.



*Construction of the C-44 Stormwater Treatment Area and associated pump station in Martin County continues with 17 miles of canals and 9 miles of berms constructed. Approximately 75 percent of the 56 concrete water control structures including a spillway and gates are completed or near completion. Coupled with a reservoir being built by the U.S. Army Corps of Engineers, this project will hold and treat 50,000 acre-feet of stormwater runoff.*

When all work is complete in 2019, the Kissimmee River Restoration Project will restore flow to approximately 40 miles of the historic Kissimmee River and inundation of approximately 25,000 acres of floodplain wetlands. Over 320 species of fish and wildlife are expected to benefit.

#### **New discharge plan results in more continuous floodplain inundation for the Kissimmee River Restoration Project.**

Implemented to provide for more continuous inundation of the Kissimmee River floodplain during the 2015 wet season (June–October 2015), a new operation plan addressed concerns about low lake stages by linking discharge to lake stage.

**Dissolved oxygen in the Kissimmee River continues to meet or exceed most restoration expectations.** Essential to recovery of aquatic organisms, concentrations of daytime dissolved oxygen in the river channel of the Phase I restoration area continued to be higher in Water Year 2016 than prior to restoration.

**Birds benefit from restoration of the Kissimmee River.** White ibis, cattle egret, great egret and great blue heron wading bird colonies were active during the 2016 season within the project area and Lakes Istokpoga and Kissimmee. The peak number of nests documented throughout the basin was 1,828 compared to 2,521 last year.

**Kissimmee Chain of Lakes and Kissimmee Upper Basin Monitoring and Assessment Project moves forward.** The first year of data collection in long-term vegetation monitoring plots in East Tohopekaliga and Lakes Tohopekaliga and Kissimmee were collected. This establishes baseline conditions for reference after Kissimmee River restoration and the new regulation schedules for headwater lakes.

#### **Comprehensive Everglades Restoration Plan (CERP) Implementation**

Implemented by SFWMD and U.S. Army Corps of Engineers, projects will improve the quantity, quality, timing and distribution throughout the greater Everglades ecosystem.

The Loxahatchee River Watershed Restoration Project planning effort is underway and the Lake Okeechobee Watershed Project and the Western Everglades Restoration Project were initiated.

To help reduce discharges to the estuaries, construction is moving forward on the Indian River Lagoon - South C-44 Reservoir and STA project and the C-43 West Basin Storage Reservoir Project. Combined, they will provide over 220,000 acre-feet of additional water storage. Construction contracts for C-111 South Dade have been awarded and SFWMD's effort to expedite moving water south through Taylor Slough into Florida Bay is underway. Modified Water Deliveries to Everglades National Park project is nearing completion.

This has been a year of unprecedented progress with the signing of project partnership agreements for the C-43 West Basin Storage Reservoir, Biscayne Bay Coastal Wetlands Phase 1 and Broward County Water Preserve Areas Phase 1 projects. These projects combined put the necessary infrastructure in place to facilitate sending larger quantities of water south on a long-term basis in accordance with the Governor's 20-year plan and the District's strategic mission.

#### **Florida Bay**

Low rainfall conditions from Water Year 2015 continued into Water Year 2016 with rainfall in the region remaining well below normal until December 2015. This severe, but localized, drought contributed to low flows to Florida Bay, accompanied by water temperatures well above normal. The 365-day cumulative flow to Florida Bay from five monitored creeks reached a record low of 77,644 acre-feet in August 2015. Salinities in the central region of the bay exceeded 50 and the area experienced an extensive turtle grass die-off within an area of approximately 40,000 acres.

SFWMD initiated implementation of an innovative plan to deliver needed fresh water to Florida Bay, an immediate first step to help reduce salinity levels in the bay and promote recovery of seagrasses until larger Everglades restoration projects are built and completed. Operational improvements increase flow of water directly into Taylor Slough in Everglades National Park, a major source of fresh water for the bay. Additional water reaching the bay during both dry and wet seasons meets stringent water quality standards.

## Annual Plans and Reports

### Five-Year Capital Improvements Plan

Over the next five years, the South Florida Water Management District estimates spending \$1.7 billion on projects contained in its Five-Year Capital Improvements Plan. The plan reflects ongoing commitments to District Governing Board priorities for Fiscal Year 2016-2017 through Fiscal Year 2020-2021, including an estimated \$1.3 billion for restoration projects. The balance is allocated for other agency priorities related to water supply and operations and maintenance.

The Fiscal Year 2016-2017 adopted budget included a planned capital improvements project budget of \$345 million. Based on the revised estimated project schedules, the District's Five-Year Capital Improvement Plan was adjusted to a total of \$313 million for Fiscal Year 2016-2017. The difference of \$32 million in state funding is primarily dedicated for the C-43 West Storage Reservoir and has been rebudgeted in the Fiscal Year 2017-2018 preliminary budget.

The state Fiscal Year 2016-2017 budget provided for a significant increase in restoration funding when compared to the FY2015-2016 budget. The FY2016-2017 budget increased by approximately 27% for land acquisition (\$27.7 million), 42% for project planning, design, engineering and construction (\$141 million), and by more than 90% (\$52.8 million) for dispersed water management activities.

## Regulatory Reports

### Reports are prepared annually to comply with permits

issued to the South Florida Water Management District by the U.S. Army Corps of Engineers or by the Florida Department of Environmental Protection to construct and operate regional restoration projects. If a specific project is operational, a detailed annual report with monitoring information and compliance with specific permit conditions are provided as a separate appendix in the *South Florida Environmental Report*. Otherwise, a project status update is presented in the associated chapter.

## Consolidated Project Database

### The online South Florida Environmental Report

**Consolidated Project Database** at [www.sfwmd.gov/sfer](http://www.sfwmd.gov/sfer) provides rapid data sorting, searches and retrieval for comprehensive updates on many projects referenced in the 2017 South Florida Environmental Report. The database enables rapid data sorting, searches and retrieval for efficient information and project management.

The complete *2017 South Florida Environmental Report* is available online at [www.sfwmd.gov/sfer](http://www.sfwmd.gov/sfer).



In Palm Beach County, construction of the L-8 Flow Equalization Basin (FEB) is expected to be completed in 2017. This Restoration Strategies project is built to capture and temporarily store peak stormwater flows. Water managers can move water from FEBs to Stormwater Treatment Areas (STAs) at steady rates to optimize STA performance and help achieve water quality improvement targets.



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